

**IN THE UNITED STATE PATENT AND TRADEMARK OFFICE**

**UTILITY PATENT APPLICATION**

**CARGO RACK**

**BACKGROUND OF THE INVENTION**

This invention relates in general to a shelving unit and more particularly to the structural beams in the shelving unit. Several products are similar to this product in that they rely on beams affixed to posts to form a rigid shell that in turn supports shelf members. Examples of such prior art are illustrated in the following patents: 5,553,549 and 5,749,481.

Similar frameworks are typically provided with four vertical corner posts and a plurality of horizontal members. For example, U.S. Patent 5,553,549 issued to Nilsson discloses a framework for a shelving unit comprising horizontal members, a plurality of vertical posts, and a locking attachment for connecting the horizontal members to the vertical posts. One disadvantage of this prior art design is that the horizontal support members do not provide enough load bearing capabilities. A further result of this is a poor utilization of material. The material gauge or thickness is higher than necessary and the strength to material weight ratio could be improved which may result in a lower cost per unit of capacity.

U.S. Patent 5,749,481 issued to Miller utilizes a storage rack and a structural beam to maximize the strength of the beam construction. However, the storage rack and structural beam of this patent are very large. Its size assumes a consumer will have an excess of space to house the rack. The storage rack utilizes a structural member to ensure that decking members and pallets will be adequately supported. While the rack has greater strength capabilities, it is very large in size and in weight. The structural beams are connected to the support columns or posts by removeable attachment pins. Specifically, each beam is provided with an upright

connector plate with holes for receiving a pin which is then inserted through a selected hole in the vertical column or post. Another disadvantage of this prior art design is that there are a multiplicity of components required for assembly including the aforementioned pins as well as pliers or screwdrivers. Furthermore, it is possible for the nuts and bolts to become loosened over time, thereby resulting in potential instability of the shelving assembly.

Previous structural beams have been used in similar shelving units. An example is a beam model that had a profile of an "L" shape. The beam simply had a flange that came off perpendicular to the top of the beam. Although there are other differences between this prior art and the present invention such as the shape of apertures on the vertical posts, the crux of this prior art is the cross section of the beam profile. The shelving unit containing this beam is an adequate shelving unit. However, this beam does not have a large load bearing capacity. The overall strength and capacity may be substantially improved. Namely, it is possible to provide greater rigidity against horizontal deflection of the beam and maintain the depth of the unit by providing additional rigidity against deflection.

#### BRIEF SUMMARY OF THE INVENTION

These and other problems and disadvantages associated with the prior art are overcome by the invention disclosed herein by providing a structural beam in the form of three embodiments for a storage unit that minimizes cost per unit, maximizes strength to material weight ratio, is easily assembled, and ensures that cargo will be adequately and better supported.

The invention is directed to the structural beams and to the shelving unit embodying the structural beams. The structural beams are produced in three styles. Two of the styles allow the shelf member to be mounted in a recessed position on the beam while the other style allows

the shelf member to be mounted on top of the beam thereby being completely exposed. One recessed structural beam contains a return flange at its base, a recessed flange at its top, and a rib formed there between. The second recessed structural beam is a slight variation of the first in that it does not include a rib; however, it contains a return flange at its base and a recessed flange at its top. The standard structural beam contains an angled return flange at its base, a standard angled flange at its top, and a rib there between.

The cross section and profile of each of the beams in the framework results in greater rigidity and column strength. The cross-section of the beams' profiles improves the strength by "stiffening" the beam, and reducing the amount of deflection under loading. This allows a stronger unit at greater load bearing capacities with less material. The beams offer a combination of strength and ruggedness and a unique appearance.

The primary purpose of the rib, as used with both recessed and standard beams, is to provide rigidity against horizontal deflection. However, it also maintains the depth of the unit and provides additional rigidity against deflection in this axis. Furthermore, the return flanges of all three beams provide rigidity against horizontal axis deflection. The return flanges also maintain the depth of the unit and provide additional rigidity against deflection in this axis.

The standard angled flange on the standard structural beam adds rigidity to the beam and supports the shelving member from its bottom. The concept for a slight angle in the flange was designed and based on the flexibility of particle board used as shelving. As a load is applied, the board will begin to flex. The gap created by the form will begin to close and, as the load is progressively applied, will establish complete surface contact. Therefore, the unit gathers additional support as the load becomes heavier all the way up to the complete surface contact.

Furthermore, the angled return flange as used in the standard beam comes into effect as weight is applied and deflection begins. As indicated in the drawing, the part itself begins to bend or flex outward. As the applied load increases, the angled return flange provides additional resistance against this movement.

The recessed flange; however, provides support to the shelving member from the sides as well as the bottom. In doing so, the recessed flange maintains the integrity of a single piece of steel. There is no need for a completely separate part to trap the sides of the particle board, provide support from the bottom, and establish a double thickness of material. The strip width of the steel is established to accommodate a 180 degree return bend and 90 degree flange. The 180 degree return bend has a double thickness that also adds rigidity to the edge of the material. This not only distributes static and dynamic loads, but also contributes additional overall strength and capacity. The recessed flange is designed such that once the framework on the unit is assembled, the shelving member will drop into the frame and rest inside the beams and braces.

The shelving unit of the present invention preferably includes at least 4 vertical post members mutually spaced from one another. The structural beams are orientated perpendicular to post members and removeably associated therewith taking the form of a parallelogram. The shelving unit is complete when shelf members are removeably attached to the structural beam and vertical post framework. Various attachments may be added to the shelving unit when the recessed structural beams are used. These and other features will become more clearly understood upon consideration of the following detailed description and accompanying drawings.

## BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

FIG 1 is an isometric view of the shelving unit;

FIG 2 is a broken view of the apertures on a vertical post;

FIG 3 is a broken view illustrating the connection between the shelving member and the structural beam via the recessed flange;

FIG 4 is an exploded view illustrating the recessed structural beam with ribbing to vertical post assembly via nubs and apertures;

FIG 5 is a cross sectional view of the profile of the recessed structural beam with ribbing;

FIG 6 is a corner view illustrating a shelf member being installed and positioned by the recessed flange;

FIG 7 is a broken top view of the corner of the shelving unit;

FIG 8 is a pictorial view of an example of one profile possible with an attachment;

FIG 9 is the side view of the example profile for the attachment shown in FIG 8;

FIG 10 is an exploded view illustrating a standard structural beam with ribbing being assembled to vertical post via nubs and apertures;

FIG 11 is a cross sectional view taken along a plane passing through the line 11 / 11 and looking in the direction of the arrows of the line 11 / 11 of the standard structural beam;

FIG 12 is a corner view illustrating a shelf member being installed and positioned by the standard beam with ribbing and the angled flange; and

FIG 13 is a cross sectional profile of the recessed structural beam without ribbing.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Fig. 1, the assembled shelving unit 1 is shown including four vertical posts

10. Each vertical post 10 has a pair of legs 20, 21 perpendicular to one another as shown in Fig. 4. A plurality of structural beams 2, 25, or 30 and horizontal shelving members 12 extend between the pairs of legs 20, 21 on vertical posts 10 and are attached in a manner to be described below.

The recessed structural beams 2 include a rib 8, with a recessed flange 6, and a return flange 4 as seen in Fig. 5. The rib 8, recessed flange 6, and return flange 4 terminate in a vertical edge of the recessed structural beam 2. The recessed flange 6 is chamfered at the ends of its base 7 in order to enable assembly to appear as seen in Fig. 4 once it has moved along the dashed lines to engage the legs 20, 21 of the vertical post 10.

The recessed structural beam 2 is preferably and approximately 2.5 inches in height. The recessed flange 6 is preferably and approximately 0.56 inches in height and 0.47 inches in length. The center point of the rib 8 is preferably and approximately located 0.88 inches from the base of the recessed structural beam 2. The rib 8 is roughly 0.338 inches in height with radiuses at its ends of about 0.095 inches while its center radius is at approximately 0.11 inches. The horizontal return flange 4 is approximately 0.22 inches in length. The location and/or dimensions are critical to the overall capacity of the product. However, the major features are the characteristics of the shape of these attributes. The specific locations do not materially affect the overall capacity. While the above listed dimensions are preferred, other combinations are possible.

The recessed structural beams 30 combine a recessed flange 31 and a return flange 32 as seen in Fig. 13. The recessed flange 31 and return flange 32 terminate in a vertical edge of the recessed structural beam 30. The recessed flange 31 is chamfered at its base 33 in order to enable assembly much in the same way as recessed flange 6 is chamfered at its base 7 on

recessed structural beams 2 as shown in Fig. 4 once it has moved along the dashed lines to engage the legs 20, 21 of the vertical post 10.

The recessed structural beam 30 is preferably and approximately 2.8 inches in height. The recessed flange 31 is preferably and approximately 0.566 inches in height and 0.47 inches in length. The horizontal return flange 32 is preferably and approximately 0.22 inches in length. The location and/or dimensions are critical to the overall capacity of the product. However, the major features are the characteristics of the shape of these attributes. The specific locations do not materially affect the overall capacity. While the above listed dimensions are preferred, other combinations are possible.

The standard structural beams 25 includes a rib 26 formed between an angled standard flange 27 and an angled return flange 28 as seen in Fig. 11. The rib 26, angled standard flange 27, and angled return flange 28 terminate in a vertical edge of the standard structural beam 25. The angled standard flange 27 is chamfered in order to enable standard structural beam assembly to appear as seen in Fig. 10 once it has moved along the dashed lines to engage the legs 20, 21 of vertical post 10.

The standard structural beam 25 is preferably and approximately 2.25 inches in height. The angled standard flange 27 is preferably and approximately 0.385 inches in length forming an acute angle of approximately 85 degrees with the vertical portion of the beam 25. The rib 26 is preferably and approximately 0.338 inches in height with radiuses at its ends of about 0.095 inches while its center radius is at approximately 0.11 inches. The angled return flange 28 is approximately 0.23 inches in length forming an acute angle of approximately 85 degrees with the vertical portion of the beam 25. The location and/or dimensions are critical to the overall capacity of the product. However, the major features are the characteristics of the

shape of these attributes. The specific locations do not materially affect the overall capacity. The above listed dimensions are preferred, but other combinations are possible.

Structural beams 2, 25, and 30 are provided with nubs 14 which are welded to said structural beams 2, 25, and 30 which can be seen in Fig. 5 , Fig. 11 and Fig. 13 respectfully. The purpose of nubs 14 is to enable structural beams 2, 25, and 30 to be associated with the vertical post 10. A pair of nubs 14 are located at each end of structural beams 2, 25, and 30. The vertical location of each pair of nubs 14 must be relative to the vertical distance between the key shaped apertures 18 on legs 20 and 21 on vertical post 10. The horizontal location of nubs 14 on structural beams 2, 25, and 30 must be such that they would enable a corner fit between structural beams 2, 25, or 30 such as shown in Fig. 6 and Fig. 12. As such, each pair of nubs 14 will be proportionate across the vertical centerline of structural beams 2, 25, and 30.

As seen in Fig. 1 and Fig. 2, the vertical posts 10 are provided with a plurality of key shaped apertures 18 each generally comprising a circular hole 19 with a slot 19a that extends slightly downward from the larger circular hole 19. These key shaped apertures 18 along with nubs 14 enable beams 2, 25, and 30 to be assembled to the vertical post 10.

To assemble the framework, the vertical posts 10 should be orientated in a way such that the legs 20, 21 of each post 10 are aligned with the legs 20, 21 of the remaining 3 posts to form a rectangular shape within the legs 20, 21 of all four posts 10. The structural beams 2, 25, or 30 can then be removeably attached to the vertical posts 10 such as seen in Fig. 4 or Fig. 10. In operation, the nubs 14 are inserted through respective key shaped apertures 18 such that the nub head 15 of the nub 14 passes through the circular hole 19 as shown in Fig. 4 and Fig. 10. To removeably lock the beams 2, 25, or 30 to the vertical posts 10, the structural beams 2, 25, 30 and the nubs 14 should be adjusted downward so that the nub neck 15a becomes positioned



in the slots 19a as seen in Fig. 6 and Fig. 12. The shape of the circular hole 19 corresponds to that of the nub head 15 and the width of the slot 19a corresponds to that of the nub neck 15a. The structural beams 2, 25, or 30 are secured to the posts 10 using this method due to the tight fit created between the nub neck 15a and the slots 19a combined with the weight of said beams 2, 25, or 30 in conjunction with gravity to hold said beams 2, 25, or 30 in place. This process should be repeated until all structural beams 2, 25, or 30 are removeably attached to the vertical posts 10.

Once structural beams 2, 25, or 30 are associated to vertical post 10, it is then possible to removeably associate shelf member 12 to the unit thereby completing the shelving unit 1. To associate with the recessed structural beams 2 or 30, shelving members 12 are positioned to rest on the recessed flange base 7 or 33 of recessed flanges 6 or 31 of the recessed structural beams 2 or 30, respectively, as seen with recessed structural beams 2 in Fig. 6. To associate with the standard structural beams 25, shelving members 12 are positioned to rest on top of angled standard flange 27 as seen in Fig. 12. The shelving member 12 is secured due to the weight of the shelving member 12 in conjunction with gravity.

The shelving members 12 can include particle board, wood board, plywood, or any similar material. The shelving members 12 generally have a rectangular shape as seen in Fig. 1. The shelving members 12 contain a taper 16 as seen in Fig. 3 to provide clearance for various attachments when used with recessed structural beams 2 or 30. The taper 16 is such that the distance from the end of the shelving member base 17 to the vertical centerline of the shelving member is greater than the distance from the end of the shelving member top 17a to the vertical centerline of the shelving member. This is true for all 4 sides of the shelving member 12.

Various attachments such as the one pictured in Figs. 8 and Fig. 9 will fit securely on the recessed flange side 7a. The clearance provided between the shelving member top 17a and the recessed flange side 7a, enable the attachment 22 to become removably attached to the shelving unit 1 via the recessed flange side 7a. The upper hook 23 of the attachment 22 is of a shape which corresponds to thickness of the recessed flange side 7a such that the upper hook 23 securely fastens to said recessed flange side 7a thereby creating a tight fit as seen in Fig. 9. Although the upper hook 23 of the attachment 22 must remain constant in size and shape, the base 23a of the attachment 22 may be varied to hold different objects such as hammers or brooms.

It may thus be seen that the objects of the present inventions set forth as well as those made apparent from the foregoing description, are officially obtained. While the preferred embodiments of the invention have been set for purposes of disclosure, modification of the disclosed embodiments of the invention as well as other embodiments thereof may occur to those skilled in the art. Accordingly, the appended claims are intended to cover all embodiments which do not depart from the spirit and scope of the invention.